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Effect of the nature of silicon oxide structures on the activity of an alumina-chromium catalyst in the reaction of iso-butane dehydrogenation

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Abstract

The formation of silicon oxide structures in the composition of an alumina-chromium catalyst for the dehydrogenation of iso-butane is studied by means of nitrogen adsorption, XRD analysis, solid-state 29Si NMR spectroscopy, temperature-programmed desorption of ammonia, and UV-Vis and Raman spectroscopy. It is established that 0.5-1.2 wt % silicon was distributed on the catalyst surface in the form of Si(OSi)4 structures. As the silicon content was increased to 2.2-3.6 wt %, Si(OSi)3(O-) structural elements were present on the surface in addition to Si(OSi)4. The formation of silicon oxide structures on the catalyst surface was responsible for an increase in the concentration of Cr(III) ions and a decrease in the surface acidity; the activity and selectivity of the catalysts in the reaction of iso-butane dehydrogenation increased. © Pleiades Publishing, Ltd., 2014.

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Keywords

Alumina-chromium catalyst, Chromium(III) oxide, Dehydrogenation, Silicon